

PROJECT ADMINISTRATION DATA SHEET



ORIGINAL



REVISION NO. _____

Project No. A-3505

GTRI/ST

DATE 4/6/83Project Director: Joe M. Newton~~Research~~/Lab EMLSponsor: U. S. Army Missile Command; Redstone Arsenal, AL 35898Type Agreement: Delivery Order No. 0005 under Contract DAAH01-83-D-A013Award Period: From 3/24/83 To 5/31/83 (Performance) 7/31/83 (Reports)Sponsor Amount: Total Estimated: \$13,100Funded: \$13,100Cost Sharing Amount: \$ None

Cost Sharing No: _____

Title: DAFFR Flight Test Program

ADMINISTRATIVE DATA

OCA Contact Frank H. Huff x4820

1) Sponsor Technical Contact:

Dr. M. M. HallumSystems Simulation & Dev. DirectorateUS Army Missile CommandUS Army Missile LaboratoryATTN: DRSMI-RDFRedstone Arsenal, AL 35898

2) Sponsor Admin/Contractual Matters:

Mr. Thomas A. BryantOffice of Naval ResearchRoom 206, O'Keefe Bldg.Georgia Institute of TechnologyAtlanta, Georgia 30332Defense Priority Rating: D0-A2 under DMS Reg 1Military Security Classification: Unclassified (general
(or) Company/Industrial Proprietary scope of work)

RESTRICTIONS

See Attached Gov't Supplemental Information Sheet for Additional Requirements.

Travel: Foreign travel must have prior approval — Contact OCA in each case. Domestic travel requires sponsor

approval where total will exceed greater of \$500 or 125% of approved proposal budget category. See additional re-
strictions on re-budgeting travel funds: (1) B-2(c) (page 3 of basic agreement)

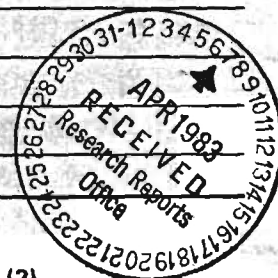
Equipment: Title vests with _____

Government; except that items costing less than \$1,000 vest with GIT if prior approval to purchase is obtained from the Contracting Officer.

COMMENTS:

Send information copy of all correspondence addressed to Administrative Contracting Officer (ACO) to Commander, US Army Missile Command, Attn: DRSMI-ICDB, Redstone Arsenal, AL 35898

COPIES TO:

Research Administrative Network
Research Property Management
Accounting
Procurement/EES Supply ServicesResearch Security Services
~~Reports Coordinator (OCA)~~
GTRI
LibraryResearch Communications (2)
Project File
Other Newton
Other _____

SPONSORED PROJECT TERMINATION SHEETDate August 3, 1983

Project Title: DAFFR Flight Test Program

Project No: A-3505

Project Director: Joe M. Newton

Sponsor: U.S. Army Missile Command; Redstone Arsenal, AL 35898

Effective Termination Date: 5/31/83Clearance of Accounting Charges: 5/31/83

Grant/Contract Closeout Actions Remaining:

- ☒ Final Invoice and ~~Closing Documents~~
- ☐ Final Fiscal Report
- ☒ Final Report of Inventions
- ☒ Govt. Property Inventory & Related Certificate
- ☐ Classified Material Certificate
- ☐ Other _____

Assigned to: EML (~~School~~/Laboratory)COPIES TO:

Administrative Coordinator
Research Property Management
Accounting
Procurement/EES Supply Services

Research Security Services
Reports Coordinator (OCA) ✓
Legal Services (OCA)
Library

EES Public Relations (2)
Computer Input
Project File
Other Proj. Director

FINAL TECHNICAL REPORT
and
Monthly Technical Report #1
Cost and Performance Report #1 and #2

DAFFR Flight Test Program
Georgia Tech Project A-3505

May 1983

J. M. Newton
P. P. Britt

Contract No. DAAH01-83-D-A013
Delivery Order No. 0005
Georgia Tech Project Number A-3505

Prepared for
U. S. Army Missile Command
Advanced Sensors Directorate
Redstone Arsenal, Alabama 35898

Prepared by
Engineering Experiment Station
Georgia Institute of Technology
Atlanta, Georgia 30332

1.0 INTRODUCTION

During this program, the Georgia Institute of Technology supported the operation of the DAFFR radar system. Specifically, the following tasks were performed:

- a. The video line receiver circuit from the Radar Electronics Unit (REU) was redesigned, rebuilt and installed in the radar.
- b. The video Splitter Box assembly was rebuilt and installed in the radar.
- c. The line Driver/Receiver circuit in the radar mainframe was redesigned, rebuilt and installed in the radar.
- d. The Range Timing Board in the REU was redesigned, rebuilt and installed in the radar.
- e. On site support at Eglin AFB, Florida was provided.

2.0 ON-SITE DAFFR RADAR SUPPORT

On March 23, 1983 an engineer from Georgia Tech went to Eglin AFB, Florida to provide on-site support for the DAFFR radar. The primary goal of the trip was to calibrate the angle transfer function of the radar. When the engineer arrived it was learned that the DAFFR inertial measurement unit (IMU) on the launcher was not operational. Therefore, it was not possible to accomplish the radar calibrations immediately; initial efforts were directed at verifying the proper functioning and installation of the radar.

The DAFFR vehicle was initially located in an open field, with trees to the left and a 75 foot telephone pole directly in front of the radar. A test plan was devised on the site to checkout the error signal transfer characteristics. The test plan

called for a corner reflector to be located at the top of the telephone pole to serve as a reference target for calibrating the radar angle discriminator. Unfortunately, the trees to the left of the radar had a very large radar cross-section and the signals reflected from them masked the return from the corner reflector.

In an attempt to eliminate the unwanted reflections from the trees, the DAFFR vehicle was relocated to put the trees in the antenna backlobes and also outside of the target range bin. This worked as expected, reducing the signal level from the trees significantly. However, with the smaller reflection level from the trees, it became apparent that the signals being returned from the telephone pole were more than sufficient to contaminate the signal returned from the corner reflector. The large cross-section of the pole was the result of the pole being vertical to the incident wavefront, thereby, creating a normal reflection condition. In addition, the pole had many metal foot pegs which increased the reflection greatly. It was concluded that a better method would have to be found to provide a clutter-free target for angle calibration. Suspending a reflector from a tethered balloon seemed to be the most promising, but test time did not permit the implementation of this during the on-site support by Georgia Tech.

During these experiments it was observed that the radar provided an azimuth error output voltage that increased in magnitude as the antenna scanned away from the pole and changed signs as the antenna scanned across the pole, exactly as expected. The elevation error signal was not as well behaved. It could not be ascertained whether the poor performance of this channel was due to the extended target provided by the pole or a malfunction in the radar.

During the testing the DAFRR IMU failed and was repaired. After the unit was repaired, another attempt was made to calibrate the angle transfer function. Unfortunately, the azimuth drive mechanism for the DAFRR launch vehicle failed preventing the launcher from being rotated. Good calibration data could not be obtained due to this failure. It was possible to obtain a very crude set of azimuth data by driving the launcher/radar vehicle short distances with the wheels turned hard away from the tower. This failure plus the high noise environment prevented the collection of good calibration data.

In an effort to provide a clean signal to the radar for angle calibration, a signal generator (HP620) was installed on one of the nearby instrumentation towers. It was hoped that with the high signal-to-noise and signal-to-clutter levels at the receiver output, good angle calibration data could be obtained. However, the purity of the signal was not as good as had been hoped. Multipath between the transmitter and radar and frequency drift between the signal generator and the radar's local oscillator reduced the usability of the signal.

It was recommended that the differential frequency drift be removed by piping a strong sample of the signal from the tower directly to the AFC in the radar or by using a coherent transponder instead of the signal generator. This recommendation was not accepted for implementation during these tests but will be considered for use in case the tethered balloon target method proves to be unsatisfactory.

The one milliwatt provided by the signal generator proved to be a strong signal that, when square wave modulated, was easily discerned on the monitoring oscilloscope. During this test, the

azimuth channel appeared to be functioning properly. Adequate calibration was not obtained however, because the motion of the DAFFR vehicle in providing azimuth traverse induced considerable elevation motion. The elevation channel was again observed to be functioning in a unpredictable fashion. This time the problem was localized by swapping the receiver connections for the azimuth and elevation channels. It became obvious that the elevation channel of the RHG three channel mixer had failed. Therefore, the mixer was promptly removed and sent back to RHG for repair.

The radar was also used to investigate the clutter at the intended launch site. The launcher was located in an area of low brush with no significant trees or other large scatterers for a distance of more than one kilometer. By observation of the signal displayed on the oscilloscope used to monitor range video, it appeared that the clutter between 0.5 and 2.0 Km was not significant and it should be possible to obtain an adequate signal-to-clutter margin by employing a simple radar fence to shadow the horizon or by restricting the elevation of the positioner to angles greater than about 20 degrees.

3.0 LINE DRIVER MODIFICATIONS

Figures 1 and 2 show schematic diagrams of the redesigned line driver circuit. This new circuit should prevent the random failures that were experienced in the old unit. Operation of this device is the same as the previous circuit.

COST INFORMATION

The current financial status of the contract is as follows:

NOMENCLATURE	BUDGET	EXPENDED	FREE BALANCE
Personal Services	\$1,296.62	\$ 873.83	\$ 422.79
Material & Supplies	250.00	-0-	250.00
Travel	1,510.00	-0-	1,510.00
Fringe Benefits	186.22	183.57	2.65
Overhead	1,530.00	499.09	1,030.91

TOTAL	\$4,772.84	\$1,556.49	\$3,216.35